

REMARKS

The above amendments are made in response to the Final Office action of May 7, 2007. The Examiner's reconsideration is respectfully requested in view of the following remarks.

Claims 1-16 are pending and claims 6-16 are withdrawn from further consideration. Claims 1-5 remain for consideration upon entry of the present response. No new matter has been added.

Rejections Under 35 U.S.C. § 103

In order for an obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, coupled with knowledge generally available in the art at the time of the invention, must contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references; and that the proposed modification of the prior art must have had a reasonable expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); *In re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970); *Amgen v. Chugai Pharmaceuticals Co.*, 927 U.S.P.Q.2d, 1016, 1023 (Fed. Cir. 1996). See MPEP 2143.

Claims 1 and 3-5 stand rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Lee et al. (U.S. Patent No. 6,686,661, hereinafter "Lee") in view of Cabral et al. (U.S. Patent Publication No. 2002/0076574, hereinafter "Cabral"). The Examiner states that Lee discloses all of the elements of the abovementioned claims except, *the copper alloy layer includes a material from about 0.5 % to about 15 %, which is used to form the diffusion barrier layer*, which the Examiner further states is disclosed primarily in FIGS. 4, 5A and 5B and paragraphs 0007, 0014, 0015, 0033 and 0045 of Cabral. Applicants respectfully traverse for at least the reasons set forth below.

Lee does not disclose *a diffusion barrier layer formed directly on the substrate* as recited in independent claim 1.

In particular, Lee discloses with respect to FIG. 4, and similarly in FIGS. 3, 6A and 6B, relied upon by the Examiner, disclose a substrate 1 and a copper alloy line 200 and an aluminum oxide 201 (refer to Fig.4). The copper alloy line 200 includes aluminum (Al) and is formed on the substrate 1. The aluminum of the copper alloy line 200 moves into the substrate 1 to form the aluminum oxide 201 between the substrate 1 and the copper alloy line 200. An oxidation reaction of Al from the copper line 200 and substrate 1 occurs in the downward direction (arrow 204) at the interface therebetween. The aluminum oxide 201 serves to prevent silicon from diffusing into the copper line 200 thereby preventing an increase in the resistivity of the copper line 200. (Col. 6, lines 39-62.) Therefore, Lee teaches a copper alloy line 200 containing Al and Mg **formed directly** on the substrate 1.

In contrast, the present invention includes a silicon-containing substrate 10, a diffusion barrier layer 11b formed directly on the substrate and a copper alloy layer 12a formed on the diffusion barrier layer in claim 1. **The copper alloy layer 12a includes a material formed from about 0.5at% to about 15at%, which is used to form the diffusion barrier layer.**

Likewise, Cabral discloses in FIG. 4 relied upon by the Examiner that the interlayer dielectric layer 22 is directly formed on the substrate 14. Further, the first metal layer 20 is on the interlayer dielectric layer 22 and a polish stop layer 26 (i.e., usually formed of silicon nitride, but may be any low dielectric constant material) is formed on the interlayer dielectric. A liner layer 24 (i.e., equated to the diffusion barrier layer of the present invention), in turn, is on the polish stop layer 26. (See Fig. 4 and paragraphs [0045-0046].) Therefore, Cabral discloses the diffusion barrier layer 24 formed directly on the polish stop layer 26.

Furthermore, Cabral discloses a conductor body 44 and a liner 42 (refer to FIG. 5A, and paragraphs 14, 15, 33 and 45). The conductor body 44 is formed of an alloy including between about 0.001 atomic % and about 2 atomic % of an element selected from the group consisting of Ti, Zr, In, Sn and Hf, and further includes Cu and Al. The liner 42 is formed of an alloy that includes Ta, W, Ti, Nb and V. For example, the liner 42 includes about 18-40 atomic % of Ti. Thus, **it is not clear that Cabral discloses that the conductor body 44 includes the same material as the liner 42.**

In contrast, the present invention includes a copper alloy layer 12a and a diffusion barrier layer 11b in claim 1. The copper alloy layer 12a includes a material from about 0.5at% to about 15at%, which is used to form the diffusion barrier layer. Thus, **the copper alloy 12a includes the same material as the diffusion barrier layer, and the material content of the copper alloy is different from the material content of the conductor body 44.**

It is respectfully submitted that neither Lee nor Cabral, either alone or in combination, teach or suggest **a diffusion barrier layer formed directly on the substrate; and a copper alloy layer formed on the diffusion barrier layer, the copper alloy layer including a material from about 0.5at% to about 15at%, which is used to form the diffusion barrier layer,** as recited in independent claim 1.

Thus, it is respectfully submitted that claim including claims depending therefrom, i.e., claims 2-5, define over Lee in view of Cabral.

Claim 2 stands rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Lee in view of Cabral and further in view of Farrar (U.S. Patent Publication No. 2002/0182858, hereinafter "Farrar"). The Examiner states that Lee in view of Cabral discloses all of the elements of claim 2 except, *the diffusion barrier layer is a silicide compound*, which the Examiner further states is disclosed primarily in paragraph 0038 of Farrar. Applicants respectfully traverse for at least the reasons set forth below.

First, it is respectfully pointed out that claim 2 depends from claim 1, which is submitted as being allowable for defining over Lee in view of Cabral as discussed above. Second, it is respectfully submitted that use of *the diffusion barrier layer being a silicide compound* allegedly disclosed in Farrar or any other disclosure of Farrar does not cure the deficiencies noted above with respect to Lee in view of Cabral.

Thus, Applicants submit that neither Lee, Cabral, nor Farrar, either alone or in combination, render obvious the subject matter of amended claim 1. Claims 2-5 depend from amended claim 1, and thus includes the allowable elements of amended claim 1. It is thus believed that the dependent claims are patentable over the cited references for at least the reasons given above for amended independent claim 1.

Accordingly, it is respectfully submitted that the claimed invention is allowable over the cited references. The Examiner's withdrawal of the rejection of claims 1-5, and their subsequent allowance are respectfully requested.

Conclusion

In light of the above remarks, the present application including claims 1-5 are believed to be in condition for allowance.

Accordingly, Applicants respectfully request that the Examiner reconsider and withdraw the outstanding rejections. If there are any charges due with respect to this response, please charge them to Deposit Account No. 06-1130 maintained by Applicants' Attorneys.

Respectfully submitted,

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